REMARKS

All claims 1-43 stand rejected in the present application. All rejections are respectfully traversed, for the reasons described below.

Art Rejections

The art rejections are all respectfully traversed.

Claim 1

For purposes of discussion, claim 1 is reproduced below:

> 1. (original): A method for calculating edge functions for a patch of pixels, comprising the actions of:
> computing edge function values for at least one interior point within said patch; and
> computing edge function values for multiple other points within said patch, using an arithmetic combination of
> said edge function values for said interior point,
> together with previously computed values of said edge functions for points on the border of said patch,
> together with a reduced set of offset vectors.

In rejecting claim 1, Examiner cites the Pineda reference, which describes an algorithm for rasterization of polygons. However, the Pineda reference fails to teach or suggest, and also teaches away from, the claimed limitation of, "computing edge function values for multiple other points within said patch...together with a reduced set of offset vectors." [Emphasis added.]

Examiner addresses this limitation at page 5 of the current Office action, stating,

> together with a reduced set of offset vectors, at page 18 first column with "This function is convenient for rasterization algorithms, since it can be computed incrementally by simple addition:
>
> $$E(x+1,y)=E(x,y)+dY$$
> $$E(x,y+1)=E(x,y)-dX$$
>
> The edge function is related to the error value or "draw control variable" (DCV) in Bresenham line drawing algorithms [1,2]. The difference is that Bresenham line drawing algorithms maintain the DCV value only for pixels within 1/2 pixel of the line, while E(x,y) is defined for all pixels on the plane. In addition, the value of DCV differs from E(x,y) by a constant offset. In any case, the reason that both algorithms work is fundamentally the same"...

Examiner goes on to describe the edge functions, stating,

> "The edge functions may then be computed incrementally for a unit step in the X or Y direction:
>
> $$Ei(x+1,y)=Ei(x,y)+dYi$$
> $$Ei(x-1,y)=Ei(x,y)-dYi$$
> $$Ei(x,y+1)=Ei(x,y)-dXi$$
> $$Ei(x+1,y-1)=Ei(x,y)+dXi$$
>
> As can be seen, the above equations define vectors with offsets, which are collinear with the primitive edges."

Applicant respectfully submits that these edge functions do not teach or suggest a "reduced set" of offset vectors, as described in the present application. This citation by Examiner shows a set of offset vectors capable of traversing each and every pixel, by going stepwise, without taking advantage of any symmetry relations, complements, or shifts as taught and claimed in the present application. The teachings of Pineda do not appear to teach that any offset vectors can be omitted from the set in computing edge functions. The method as presented by Examiner has been improved upon by the teaching of the present application, as described more fully below.

The claimed language "reduced set of offset vectors" refers to the present application's teaching that many of the offsets are not unique, and thus some calculations can be

potentially re-used or omitted. For example, Applicants point to the specification at, for example, page 8 lines 22-25:

> As can be seen from Figure 1B, the use of the middle point as a reference means that many of the offsets are not unique, and so each calculation can be re-used multiple times. Two further methods are used to reduce the number of calculations required.

Those further two methods are described, the first at page 8, line 27-page 9, line 4, which states:

> **Figure 1A** shows how a reduced set of offset values are combined with incremental reference points, in a sample embodiment, to permit rapid calculation of an edge function for all pixels in a patch. Since all calculations are done using binary arithmetic, scaling by 2 or 4 is done by shifting the number, so for example, the calculation of +2dx+2dy is not necessary, as this is simply the result of (+1dx+1dy)*2.

It is noted that the cited reference does not teach or suggest, for example, the above-described scaling.

For the reasons described above, it is respectfully submitted that the cited reference does not teach computing edge function values using a "reduced set of offset vectors," as claimed in claim 1. If Applicant has overlooked a relevant teaching, it is respectfully requested that such teaching be pointed out with particularity.

Further, Applicants respectfully submit that the cited reference explicitly teaches away from the present invention, as will be described below.

The second method is described at page 9, lines 5-15:

> Many of the remaining calculations required are simply the negative of another calculation (e.g., -1dx-1dy = -(+1dx+1dy)). As 2's complement arithmetic is

being used, to calculate the negative of a number, the bits are inverted and 1 is added to this new number. However, as this number is then used in a comparison, instead of incrementing the number, the type of comparison done can be changed, to get the increment for free since the expressions (A<(B+1)) is equivalent to (A<=B).

By applying both of these methods for decimation, only the offset values shown in the dotted and shaded squares in Figure 1A need to be calculated.

In contrast, the Pineda reference, cited by Examiner, does not teach or suggest that some of the calculations need not be performed. More specifically, the Pineda reference explicitly teaches away from the claims of the present application by teaching that the offsets are done stepwise, for each pixel, by incrementing the equations cited by Examiner and reproduced above.

For example, Pineda teaches away from the present claims at page 17, second column, the second to last paragraph, which states:

> With this formalism, it is possible to compute at each pixel center on the plane an n-tupple: (R,G,B,Z,E1....En), where R, G, B, and Z are components form the fill value, and E1...En are the values of the edge functions which are used to determine whether the pixel is interior or exterior to the polygon. Given the value of this n-tupple at a single pixel position, <u>the n-tupple of adjacent pixels can be computed by simple linear interpolators that require one addition per component per iteration.</u> [Emphasis added.]

This passage teaches that an addition is required for each component for each iteration. It does not teach or suggest the innovations of the present claims, which take advantage of complements and shifts to reduce the set of needed offset vectors.

Therefore, Applicants respectfully submit that the limitations of claim 1 are not taught or suggested in the

cited reference. Favorable reconsideration is respectfully requested.

Claim 2

Claim 2 has also been rejected over the Pineda reference. Claim 2 is reproduced for purposes of discussion:

> 2. (original): A method for calculating edge functions for a patch of points, comprising the actions of:
>
> computing the value of an edge function at an interior reference point within said patch, and at a boundary reference point on the edge of said patch; and
>
> assessing the value of said edge function at multiple other points within said patch, by comparing
>
> the value of said edge function at a respective reference point, which may be said interior reference point or said boundary reference point or a previously computed reference point, with
>
> the delta value of said edge function for a respective one of a reduced set of offset vectors;
>
> wherein said reduced set of offset vectors does not include vectors which are complements or shifts of each other.

In arguing that the cited reference Pineda teaches the claimed limitation in claim 2 of, "wherein said reduced set of offset vectors does not include vectors which are complements or shifts of each other," Examiner states in the Office action at p. 9,

> ...as can be seen, the above equations define vectors with offsets, which are collinear with the primitive edges. The vectors are neither shifts nor complements of each

> other, rather, they are vectors which incorporate delta offset complements, for example, +dYi, -dYi.

Applicant respectfully submits that the "delta offset complements" pointed out by Examiner make the vectors complements of each other.

It is noted that the cited reference does not teach or suggest the above-described scaling. If Applicant has overlooked a relevant teaching, it is respectfully requested that such teaching be pointed out with particularity. Further, Applicants respectfully submit that the cited reference explicitly teaches away from the present invention, as will be described below.

The second method is described at page 9, lines 5-15:

> Many of the remaining calculations required are simply the negative of another calculation (e.g., -1dx-1dy = -(+1dx+1dy)). As 2's complement arithmetic is being used, to calculate the negative of a number, the bits are inverted and 1 is added to this new number. However, as this number is then used in a comparison, instead of incrementing the number, the type of comparison done can be changed, to get the increment for free since the expressions (A<(B+1)) is equivalent to (A<=B).
>
> By applying both of these methods for decimation, only the offset values shown in the dotted and shaded squares in Figure 1A need to be calculated.

The cited reference fails to teach or suggest these ideas, and also fails at least to teach or suggest the claimed limitations of, "wherein said reduced set of offset vectors does not include vectors which are complements or shifts of each other." If Applicant has overlooked a relevant teaching, it is respectfully requested that such teaching be pointed out with particularity.

Claim 13

Claim 13 is also rejected over the Pineda reference. Claim 13 is believed allowable for the reasons expressed above with respect to claims 1 and 2, and because the cited reference fails to teach or suggest the claimed limitation of, "a step for using an inheritance relation to carry forward the half-plane membership function values of said reference points for a successive patch of pixels," as claimed in claim 13 of the present application.

Examiner cites Pineda at pages 19-20, stating in part,

> Since the edge function is linear, it is possible to compute the value of the edge function for a pixel at an arbitrary distance L away from a given point (x,y): E(x+L)=E(x) + Ldy. This property allows a group of interpolators, each responsible for a pixel within a block of contiguous pixels, to simultaneously compute the edge function of an adjacent block in a single cycle.

Applicant respectfully submits that, as argued above with respect to claims 1 and 2, the Pineda reference does not teach or suggest the present invention as claimed. The cited language from Pineda appears only to teach that each pixel may be traversed by adding a distance to the edge function. This does not appear to teach the claimed limitation of, "a step for using an inheritance relation to carry forward the half-plane membership function values of said reference points for a successive patch of pixels," as claimed in claim 13, and as substantially claimed in claims 31 and 37.

Therefore, it is respectfully submitted that all independent claims rejected over the Pineda reference are distinguished, and in condition for allowance. Because of their dependence on allowable claims, it is also respectfully submitted that all dependent claims are now in condition for

allowance. Favorable reconsideration of the claims is respectfully requested.

Applicant respectfully notes that independent claims 19 and 25 were not rejected over any prior art, and were only rejected under 35 USC 112, under the enablement paragraph. This issue is addressed below.

35 USC 112 first paragraph, lack of enablement

Examiner has rejected claims 2-12, 19-24, and 25-30 as not being enabled by the specification. Applicants respectfully traverse these rejections.

As mentioned above with respect to claim 2, the "reduced set of offset vectors, wherein said reduced set of offset vectors does not include vectors which are complements or shifts of each other," is described in the specification with sufficient detail so as to enable one of ordinary skill in the art to make and use the invention. The specific set of offset vectors depends on the specific application of the innovative process, and the claim language of a "reduced set of offset vectors, wherein said reduced set of offset vectors does not include vectors which are complements or shifts of each other," is not unclear. The claimed language expresses an invention wherein vectors that are complements or shifts of each other are not included in the "reduced set" of offset vectors. Applicants need not claim any specific set of vectors in order to enable one of ordinary skill in the art to use the invention.

Section 112 requires that an applicant provide an enabling disclosure of his or her invention. Specifically, the disclosure must teach a person of ordinary skill in the art how to make and use the invention without undue

experimentation. In the disclosure, however, the applicant need not teach what is well known in the art. *Lindemann Machinenfabrik GMBH v. American Hoist & Derrick Co.*, 730 F.2d 1452, 221 U.S.P.Q. 481 (Fed. Cir. 1984); *Staehelin v. Secher*, 24 U.S.P.Q.2d 1513, 1516 (Bd. Pat. App. & Int. 1992). In fact a patent preferably omits what is well known in the art. *Spectra-Physics, Inc. v. Coherent, Inc.*, 827 F.2d 1524, 3 U.S.P.Q.2d 1737 (Fed. Cir. 1987).

The test for enablement is whether the specification teaches those skilled in the art how to make and use the claimed invention without undue experimentation. *In re Vaeck*, 947 F.2d 488, 495, 20 U.S.P.Q.2d 1438, 1444 (Fed. Cir. 1991); *In re Wands*, 858 F.2d 731, 736-37, 8 U.S.P.Q.2d 1400, 1404 (Fed. Cir. 1988).

Nothing more than objective enablement is required under 35 U.S.C. § 112, first paragraph, and therefore it is irrelevant whether the requisite teaching is made through broad terminology or illustrative examples. *In re Wright*, 999 F.2d 1557, 1561, 27 U.S.P.Q.2d 1510, 1513 (Fed. Cir. 1993); *In re Marzocchi*, 439 F.2d 220, 223, 169 U.S.P.Q. 367, 369 (CCPA 1971).

In support of the claim language, "wherein said reduced set of offset vectors does not include vectors which are complements or shifts of each other," Applicants again refer to the specification at, for example, page 8 lines 22-25:

> As can be seen from Figure 1B, the use of the middle point as a reference means that many of the offsets are not unique, and so each calculation can be re-used multiple times. Two further methods are used to reduce the number of calculations required.

Those further two methods are described, the first at page 8, line 27-page 9, line 4, which states:

> **Figure 1A** shows how a reduced set of offset values are combined with incremental reference points, in a sample embodiment, to permit rapid calculation of an edge function for all pixels in a patch. Since all calculations are done using binary arithmetic, scaling by 2 or 4 is done by shifting the number, so for example, the calculation of +2dx+2dy is not necessary, as this is simply the result of (+1dx+1dy)*2.

Regarding claims 19 and 25, the term "symmetry relations," is used in the specification at page 5, as mentioned by Examiner, which states,

> By using an inheritance relation to carry forward values already computed at patch boundaries, and by using symmetry relations to shift and/or complement offset value for pixels in a patch, the computational load for each successive patch is minimized.

This statement describes how symmetry relations are implemented in the present invention, though it is respectfully submitted that the examples described in this part of the present specification is intended only as an example and is not intended to otherwise limit the scope of the claims. This use of the term "symmetry relations" is not vague or unclear, and would be understood by those of ordinary skill in the art.

Conclusion

Thus, Applicant respectfully submits that all grounds of rejection and/or objection are traversed or accommodated, and favorable reconsideration and allowance are respectfully requested. The Examiner is requested to telephone the undersigned attorney or Robert Groover for an interview to resolve any remaining issues.

Respectfully submitted,

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